Dynamics of ionospheric exit region of VLF transmitter waves

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We analyze the three field components of VLF transmitter signal waves (23.9kHz), which was transmitted from Khabarovsk in Russia and observed at the conjugate point Ceduna in Australia. The observed signals are composed of the whistler mode and earth-ionosphere waveguide mode. The wave distribution function (WDF) method and the multiple signal classification (MUSIC) method are applied to the whistler mode wave, after the signal component of the waveguide mode is removed. The earth-ionosphere waveguide effect is taken into accout by the MUSIC method, and the scale of the ionospheric exit region can be figured out by the WDF. The time variation of the estimated exit region is shown, and the non-duct propagation mechanism is mainly dicussed with the result of both methods.

It is known that the atmospheric VLF waves propagate along magnetospheric ducts in whistler mode, and arrive at the magnetic conjugate points of the sources. Meanwhile, in case of low latitude, non-duct propagation is probable since electron density of the ducts might be enhanced by a few hundreds percent. It is very important for the investigation of the propagation mechanism and magnetospheric plasma dynamics to locate the ionospheric exit regions of the VLF waves by ground-based direction findings.

In order to probe the non-duct propagation mechanism, we analyze the three field components of VLF transmitter signal waves (23.9kHz), which was transmitted from Khabarovsk in Russia and observed at the conjugate point Ceduna in Australia.

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